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Future Radioisotope Power Needs for Missions to the Solar System

for

Topical Area

Aerospace Power Systems and Technologies

Space Power Systems, Applications and Requirements

by

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NASA is no longer using single, large, highly instrumented spacecraft for space exploration. Instead NASA is identifying scientific information that is desired about our solar system and beyond and using multiple, small, low-cost spacecraft with small specific instruments to obtain that data, These smaller, low-cost spacecraft require less power, have lower launch mass and thus require lower trajectory injection energy, thereby reducing launch costs. However, to enable such spacecraft to obtain the desired scientific data, NASA needs a more efficient radioisotope power source that is compatible with the lower launch and injection mass and the lower level of power demand. By developing a new high efficiency, low mass energy converter to replace the present thermoelectric converter the number of plutonium-fueled heat sources and the specific mass can be reduced. NASA and DOE plan a cooperative team effort with industry to develop this cost, power and mass reduction in a near term 50 to 100 watt electric class advanced radioisotope space power source (ARPS) and in the process reduce the plutonium-related costs as well. The near term is focused on developing an advanced energy converter to use with the General Purpose Heat Source (GPHS) that was developed and used for the current RTGs. Advanced energy converter technologies are needed to find a more efficient replacement for the existing thermoelectric converters so that the space radioisotope power source and the plutonium mass and cost can be reduced.

A more advanced technology space radioisotope power system program is also being planned that addresses a longer term need. Twenty first century robotic scientific information missions to the outer planets and beyond are planned to be accomplished with microspacecraft which demand safe, even more compact, lower-power, lower-mass radioisotope power sources than those which can be achieved as a result of the near term efforts. The longer term program focuses not only on converter technology but also on lower power, more compact radioisotope heat source technology and lower power, smaller, lower mass radioisotope heater units for second generation microspacecraft. This more ambitious, longer time-horizon focus necessarily occurs at this time on the technology R&D level rather than at the system technology level. NASA and DOE plan a cooperative team effort with Universities, Government Laboratories and Industry to develop technologies for a 100 milliwatt radioisotope power source (MRPS) and a 10 watt electric class small radioisotope power source (SRPS) that is compatible with NASA's long term technology for low cost, low mass microspacecraft for the 21st century robotic space missions. This paper describes top level requirements for a potential need for three different sizes of space radioisotope power sources. All three must be safe, low cost, low mass and have short delivery schedules.